ACTIVITIES OF JOINT USAGE/RESEARCH CENTER

JURC Cooperative Research Subjects 2012

(1 April 2012 ~ 31 March 2013)

STARTING-UP SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

Physics of THz Generation through the Interactions of Laser with Clusters
NAGASHIMA, Takeshi, Institute of Laser Engineering, Osaka University
Host in JURC HASHIDA, Masaki

Development of Beam Irradiation System with the Use of Electron Cooled Proton Beam and Its Application
SHIRAI, Toshiyuki, National Institute of Radiological Sciences
Host in JURC NODA, Akira

Development of Methods to Measure Four Wave-mixing Process in Vacuum
HONMA, Kensuke, Graduate School of Science, Hiroshima University
Host in JURC SAKABE, Shuji

Development of Catalytic Enantioselective Reactions Induced by Hydrophobic Chiral Interface around Two-dimensionally Arrayed Gold Nanoparticles
MIKI, Kazushi, Polymer Materials Unit, National Institute for Materials Science
Host in JURC NAKAMURA, Masaharu

Optical and Electrical Properties of Mixed Organic Semiconductors
NAITO, Hiroyoshi, The School of Engineering, Osaka Prefecture University
Host in JURC KANEMITSU, Yoshihiko

Development of Negative Thermal Expansion Material Based on a Perovskite $BiNiO_3$
AZUMA, Masaki, Materials and Structures Laboratory, Tokyo Institute of Technology
Host in JURC SHIMAKAWA, Yuichi

Synthesis of Sugar-Acetylenes by Iron-Catalyzed Cross-Coupling and Study on Their Stimulus-Response Luminescence
ORITA, Akihiro, Department of Applied Chemistry, Okayama University
Host in JURC NAKAMURA, Masaharu

Mechanistic Studies on the Iron Catalyze Carbon-carbon Bond Forming Reactions Based on the Solution-phase X-ray Absorption Spectroscopy
NAGASHIMA, Hideo, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC NAKAMURA, Masaharu

Development of Ruthenium-Complex-Bound Amino Acids and Peptides and Their Application to Oxidative Degradation of Wooden Biomasses
WATANABE, Takashi, Research Institute for Sustainable Humanosphere, Kyoto University
Host in JURC NAKAMURA, Masaharu

Finding Frequent Similar Regions from Genome Sequences
NAKAMURA, Atsuyoshi, Graduate School of Information Science and Technology, Hokkaido University
Host in JURC MAMITSUKA, Hiroshi

Efficient Search Algorithms for Structured Data in Bioinformatics
TAKASU, Atsuhiro, National Institute of Informatics, Digital Content and Media Sciences Research Division
Host in JURC AKUTSU, Tatsuya

Probabilistic Methods for Analysis on Protein Interaction Networks
MARUYAMA, Osamu, Institute of Mathematics for Industry, Kyushu University
Host in JURC AKUTSU, Tatsuya

Development of Bioinformatic Method to Analyze MHC class II-binding Peptides
UDAKA, Keiko, Kochi Medical School
Host in JURC MAMITSUKA, Hiroshi

Co-clustering of Biological Datasets for Personalized Medicine
SHIGA, Motoki, Toyohashi University of Technology
Host in JURC MAMITSUKA, Hiroshi

Development of the Evaluation Method for Potential Functionome Harbored in the Genome and Metagenome
TAKAMI, Hideto, Institute of Biogeoscience, Japan Agency for Marine-Earth Science and Technology
Host in JURC GOTO, Susumu

Development of Novel 3-Dimensional π-Extended Molecules Directed toward Electronic Materials
SUGA, Seiji, Graduate School of Natural Science and Technology, Okayama University
Host in JURC MURATA, Yasujiro

Evaluation of EO Effect of High Orientation $Ba_2TiSi_2O_8$ Thin Film by Prepared Sol-gel Method
IHARA, Rie, Department of Applied Physics, Tohoku University
Host in JURC MASAI, Hirokazu

Investigation of Extraction Behaviors of Metal Ions in Liquid-liquid Extraction Systems Using a Novel Multidentate Ligand
MUKAI, Hiroshi, Faculty of Education, Kyoto University of Education
Host in JURC SOHRIN, Yoshiki

Role of Water in Motor Function of F1 Protein
IKEGUCHI, Mitsunori, Graduate School in Nanobioscience, Yokohama City University
Host in JURC MATUBAYASI, Nobuyuki

A Study on Intermolecular Atomic Contacts Involving Halogen and/or Chalcogen Atoms in Organic Crystals
TSUZUKI, Seiji, Nanosystem Research Institute, The National Institute of Advanced Industrial Science and Technology (AIST)
Host in JURC SATO, Naoki

Electronic Properties of Thin Films of Porphyrazine Derivative Compounds Containing Thiadiazole Rings

AWAGA, Kunio, Research Center for Materials Science, Nagoya University
Host in JURC SATO, Naoki

Induction of Membrane Curvature by Arginine-rich Peptides
SAKAMOTO, Kazutami, Faculty of Pharmacy, Chiba Institute of Science
Host in JURC FUTAKI, Shiroh

EXPANDING SUBJECTS
(IN SPECIFIC FIELDS CHOSEN BY JURC)

X-Ray Structure Analysis of Reaction Mechanism of Catabolic Enzymes
OIKAWA, Tadao, Faculty of Chemistry, Materials and Bioengineering, Kansai University
Host in JURC HATA, Yasuo

Efficiency Improvement of Multi-dimensional Doppler Laser Cooling for Ultra-low Temperature Beam Generation
OKAMOTO, Horomi, Graduate School of Advanced Sciences of Matter, Hiroshima University
Host in JURC NODA, Akira

X-Ray Structural Studies on Adaptation of Aspartate Rasemase to Enviromental Temperatures
GOGAMI, Yoshitaka, Kansai University High Technology Research Center
Host in JURC HATA, Yasuo

Photocarrier Recombination Dynamics in Nanodomain-structured Ferroelectrics
FUNAKUBO, Hiroshi, Interdisciplinary Graduate School of Science and Engineering, Tokyo Institute of Technology
Host in JURC KANEMITSU, Yoshihiko

Design and Synthesis of Metal Ligands Which Facilitate the Reductive Elimination Reaction and Their Application to the Synthesis of Cycloparaphenylenes
KORENAGA, Toshinobu, Graduate School of Natural Science and Technology, Okayama University
Host in JURC YAMAGO, Shigeru

Efficient Construction of Polyfunctionalized Molecules by Cooperative Effect of Transition Metals and Heteroatoms
SEGI, Masahito, School of Chemistry, College of Science and Engineering, Kanazawa University
Host in JURC TOSHIMITSU, Akio

Development of Methods for Discrimination and Syntheses of Chiral Molecules with Phosphoroselenoic Acid Derivatives Bearing a Binaphthyl Group
MURAI, Toshiaki, Faculty of Engineering, Gifu University
Host in JURC TOSHIMITSU, Akio

Development of Reversible Carbon–Carbon Bond Formation Reactions on Dynamic Tetrametallic Reaction Sites
OKAZAKI, Masaaki, Department of Frontier Materials Chemistry, Graduate School of Science and Technology, Hirosaki University
Host in JURC OZAWA, Fumiyuki

Synthesis of Cyclic π-Conjugated Molecules and Their Properties
SUZUKI, Toshiyasu, Institute for Molecular Science, National Institute of Natural Sciences
Host in JURC YAMAGO, Shigeru

Elucidation of the Mechanism of Encapsulation by Cycloparaphenylenes
HAINO, Takeharu, Graduate School of Science, Hiroshima University
Host in JURC YAMAGO, Shigeru

Cornea Regeneration by Small Molecule Fibronectin
KOIZUMI, Noriko, Department of Biomedical Engineering, Faculty of Life and Medical Sciences, Doshisha University
Host in JURC UESUGI, Motonari

Preparation of Organic-inorganic Hybrid Materials for Biosensor Application
FUJINO, Shigeru, Department of Chemical Engineering, Faculty of Engineering, Kyusyu University
Host in JURC YOKO, Toshinobu

Intracellular Gene Delivery Using Cell-penetrating Peptides
KOGURE, Kentaro, Department of Biophysical Chemistry, Kyoto Pharmaceutical University
Host in JURC FUTAKI,Shiroh

Elucidation of Excitation Relaxation Dynamics and Application of Fullerenes Directly Connected to an Organic Dye
OHKUBO, Kei, Department of Material and Life Science, Graduate School of Engineering, Osaka University
Host in JURC MURATA, Yasujiro

Synthesis, Structure and Electronic Properties of Carbazolophane-Polymers
TANI, Keita, Division of Natural Science, Osaka Kyoiku University
Host in JURC TSUJII, Yoshinobu

Making of the Vertical Cross Section of Bioactive Trace Metals in the Japan Sea
NAKAGUCHI, Yuzuru, Faculty of Science and Engineering, Kinki University
Host in JURC SOHRIN, Yoshiki

Elucidation of Dewetting Process in Polymer Blend Thin Films as Studied by Grazing-Incidence Small Angle X-ray Scattering
OGAWA, Hiroki, Japan Synchrotron Radiation Institute
Host in JURC KANAYA, Toshiji

Investigation of Effect of Loop/Bridge Conformation Ratio on Elastic Properties of the BAB Triblock Copolymer/AB Ring Diblock Copolymer Having Middle Block with Type-A Dipoles Aligned Parallel to the Chain Contour
TAKAHASHI, Yoshiaki, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC WATANABE, Hiroshi

Study of Segmental Dynamics in Multi-Component Polymer Systems in Miscible State
URAKAWA, Osamu, Graduate School of Science, Osaka University
Host in JURC MATSUMIYA, Yumi

Elucidation of Correlation between Structural Formation Process and Relaxation Process during Applying Shear Flow
MATSUBA, Go, Department of Polymer Science and Engineering, Faculty of Science and Engineering, Yamagata University
Host in JURC KANAYA, Toshiji

Analysis of Molecular Adsorption of Water and Protein on a Stereo-Controlled Acrylamide Polymers
KATSUMOTO, Yukiteru, Graduate School of Science, Hiroshima University
Host in JURC HASEGAWA, Takeshi

STARTING-UP SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Study on the Regulatory Mechanism of Plant Epidermal Cell Differentiation
TOMINAGA, Rumi, Interdisciplinary Research Organization, University of Miyazaki
Host in JURC AOYAMA, Takashi

Overexpression of Miraculin Using *Arabidopsis thaliana*
INOUE, Hiroyasu, Faculty of Human Life and Environment, Nara Women's University
Host in JURC AOYAMA, Takashi

Small Molecules that Promote Differentiation into Pancreatic Beta Cells
KUME, Shouen, Institute of Molecular Embryology and Genetics, Kumamoto University
Host in JURC UESUGI, Motonari

Study for Tunnel Magnetoresistive Effect and Local Magnetism of Magnetic Tunnel Junctions Using Co_2MnSn Heusler Alloy Electrodes Prepared by Atomically-controlled Alternate Deposition
TANAKA, Masaaki, Department of Engineering Physics, Electronics and Mechanics, Nagoya Institute of Technology
Host in JURC ONO, Teruo

Synthesis and Functions of Multi-Bridged Naphthalene Oligomers
KURAMOCHI, Koji, Graduate School of Life and Environmental Sciences, Kyoto Prefectural University
Host in JURC KAWABATA, Takeo

High-energy Ion Generation through the Interactions of Laser with Nano Particles
NAKAI, Mitsuo, Institute of Laser Engineering, Osaka University
Host in JURC SAKABE, Shuji

Identification and Functional Analysis of Bacterial Proteins Involved in Metal Metabolism
KURATA, Atsushi, Department of Applied Biological Chemistry, Faculty of Agriculture, Kinki University
Host in JURC KURIHARA, Tatsuo

Single-Electron Transistor Circuit Based on Nanoparticle
MAJIMA, Yutaka, Materials & Structures Laboratory, Tokyo Institute of Technology
Host in JURC TERANISHI, Toshiharu

Programmable Architecture of Metal Complex-metal Nanoparticle Composites
TANAKA, Kentaro, Graduate School of Science, Nagoya University
Host in JURC TERANISHI, Toshiharu

Preparation, Structure, and Electronic Properties of Thin Films of D(donor)–A(acceptor)–D and A–D–A Type Compounds
HAYASHI, Naoto, Graduate School of Science and Engineering for Research, University of Toyama
Host in JURC SATO, Naoki

EXPANDING SUBJECTS
(ON-DEMAND FROM RELATED COMMUNITIES)

Efficient Synthesis of π-Conjugated Polymers via Direct Arylation
KANBARA, Takaki, Graduate School of Pure and Applied Sciences, Tsukuba Research Center for Interdisciplinary Materials Science, University of Tsukuba
Host in JURC OZAWA, Fumiyuki

The Control of the Antiphase Boundary in Ferrimagnetic Spinel Ultrathin Films
NAGAHAMA, Taro, Laboratory of Advanced Materials Chemistry, Graduate School of Engineering, Hokkaido University
Host in JURC ONO, Teruo

Optical Functionalities of Silicon Photonic Crystals
TAKAHASHI, Yasushi, Reseach Organization for the 21st Century, Osaka Prefecture University
Host in JURC KANEMITSU, Yoshihiko

Search for Biologically Active Compounds from a Synthetic Library of Nitogen Heterocycles with Chiral Tetrasubstituted Carbon
ISHIBASHI, Masami, Graduate School of Pharmaceutical Sciences, Chiba University
Host in JURC KAWABATA, Takeo

Studies on the Transport and Metabolism of the Essential Trace Element Selenium in Mammals
MIHARA, Hisaaki, Department of Biotechnology, College of Life Sciences, Ritsumeikan University
Host in JURC KURIHARA, Tatsuo

Chemical Biology for Fine Analysis of Plant Hormone Signal Transduction Systems
HAYASHI, Ken-ichiro, Department of Biochemistry, Okayama University of Science
Host in JURC AOYAMA, Takashi

Synthesis and Properties of Well-Defined Poly(phenylene ethylene)s by Means of Organometalic Catalyst
KONISHI, Gen-ichi, Department of Organic and Polymeric Materials, Graduate School of Engineering, Tokyo Institute of Technology
Host in JURC NAKAJIMA, Yumiko

Dynamics of Spin-dependent Transport in Nanostructured Devices
KOBAYASHI, Kensuke, School of Science, Osaka University
Host in JURC ONO, Teruo

Electric and Magnetic Characteristics of New Ilmenite-type Iron Oxides
FUJII, Tatsuo, Faculty of Enginnering, Okayama University
Host in JURC SAITO, Takashi

Mechanistic Study of Calpain Modulation by Bioinformatics
ONO, Yasuko, Tokyo Metropolitan Institute of Medical Science
Host in JURC MAMITSUKA, Hiroshi

Bulk Hetero Junction Photovoltaic Devices Composed of Novel Donar Polymer and Novel Fullerene Derivatives
IE, Yutaka, The Institute of Scientific and Industrial Research, Department of Soft Nanomaterials, Nanoscience and Nanotechnology Center, Osaka University
Host in JURC MURATA, Yasujiro

Chemical Biology of GGsTop, a Compound Inducing Anti-oxidative Stress Response of Human Skin Cells
KOJIMA, Akiko, Department of Food and Human Health Sciences, Graduate School of Human Life Sciences, Osaka City University
Host in JURC HIRATAKE, Jun

SUBJECTS FOCUSING OF JOINT USAGE OF JURC/ICR FACILITIES

Nano-electron Spectroscopic Study of Helium Bubbles in Si
MIYAMOTO, Mitsutaka, Interdisciplinary Faculty of Science and Engineering, Shimane University
Host in JURC KURATA, Hiroki

Systematic Syntheses and Properties of Polycyclic Aromatics Containing a Phosphorus Atom
OKUMA, Kentaro, Department of Chemistry, Faculty of Science, Fukuoka University
Host in JURC SASAMORI, Takahiro

Physicochemical Properties of Novel Aromatic Compounds with Heteroatoms
SAITO, Masaichi, Department of Chemistry, Graduate School of Science and Engineering, Saitama University
Host in JURC TOKITOH, Norihiro

Synthesis and Structure of Transition Metal Complexes with New Tripodal Tetradentate Ligand
UNNO, Masafumi, Graduate School of Engineering, Gunma University
Host in JURC TOKITOH, Norihiro

Synthesis and Structure of Main Group Element-Protected Metal Nanoparticles
FUJIHARA, Hisashi, Department of Chemistry, Fuculty of Science and Engineering, Kinki University
Host in JURC TOKITOH, Norihiro

Synthesis and Structure of Color-tunable Organotelluronium Salts
MINOURA, Mao, School of Science, Kitasato University
Host in JURC TOKITOH, Norihiro

Structural Features of Aromatic-rings-accumulated Molecules in Crystal
OKAMOTO, Akiko, Department of Organic and Polymer Materials Chemistry, Tokyo University of Agriculture & Technology
Host in JURC NAKAMURA, Masaharu

Solid-State NMR Analysis of Molecular Orientation in Organic LED Materials
ADACHI, Chihaya, OPERA, Kyushu University
Host in JURC KAJI, Hironori

NMR Characterization of Carbon Nitride
TAKARABE, Kenichi, Department of Applied Science, Okayama University of Science
Host in JURC KAJI, Hironori

Solid-state-NMR Study on Luminescence and Structure Characteristics of Organic Molecules
TOKUDOME, Yasuaki, Graduate School of Engineering, Osaka Prefecture University
Host in JURC KAJI, Hironori

SUBJECTS ENCOURAGING JOINT PROGRAM

Elucidation of Electronic States, Local Structures, and Properties in Transition Metal Oxides Using Synchrotron Radiated X-rays
MIZUMAKI, Masaichiro, Japan Synchrotron Radiation Research Institute, SPring-8
Host in JURC ICHIKAWA, Noriya

The 8th International Workshop for East Asian Young Rheologists
TAKAHASHI, Yoshiaki, Institute for Materials Chemistry and Engineering, Kyushu University
Host in JURC WATANABE, Hiroshi

JURC Publications

(until 31 May 2012)

Dielectric and Viscoelastic Investigation of Segmental Dynamics of Polystyrene above Glass Transition Temperature: Cooperative Sequence Length and Relaxation Mode Distribution
Matsumiya, Y.; Uno, A.; Watanabe, H., *Macromolecules*, **44,** 4355-4365 (2011).
Abstract
Atactic polystyrene (PS) has the type-B dipole perpendicular to the chain backbone so that its local, segmental motion activates the dielectric relaxation. For monodisperse oligostyrene (OS) and PS samples of various molecular weights M, details of this motion were examined at temperatures T well above T_g through comparison of the complex modulus, $G^* = G' + iG''$, and the complex dielectric permittivity, $\varepsilon^* = \varepsilon' - i\varepsilon''$, measured as functions of the angular frequency ω. For the OS samples, $G^*(\omega)$ and $\varepsilon^*(\omega)$ fully relaxed through the segmental dynamics thereby exhibiting respective terminal relaxation tails (low-frequency tails), $G'(\omega) \propto \omega^2$, $G''(\omega) \propto \omega$, $\Delta\varepsilon'(\omega) \equiv \varepsilon'(0) - \varepsilon'(\omega) \propto \omega^2$, and $\varepsilon''(\omega) \propto \omega$, at ω below the segmental relaxation frequency ω_s. For the PS samples, $G^*(\omega)$ relaxed partly through the segmental dynamics and then exhibited the polymeric full relaxation characterized by the Rouse-like behavior followed by the terminal flow behavior (with/without intermediate entanglement plateau depending on M). In contrast, $\varepsilon^*(\omega)$ of the PS samples still relaxed completely through the segmental dynamics. For respective samples, the $G^*(\omega)$ and $\varepsilon^*(\omega)$ data in the segmental relaxation zone exhibited very similar relaxation mode distribution and had the same time—temperature shift factor. Nevertheless, a ratio of the dielectrically and viscoelastically detected segmental relaxation times, $r(M) = \omega_{s,G}/\omega_{s,\varepsilon}$, and the dielectric relaxation intensity, $\Delta\varepsilon(M)$, decreased with increasing M up to $M^* \cong 2 \times 10^3$ and then became insensitive to M on a further increase of M. The viscoelastic segmental relaxation reflects the cooperative torsion of the repeating units along the molecular backbone (as noted from rheo-optical data), while the dielectric segmental relaxation detects reorientational motion of those units affected by both intra- and intermolecular cooperativity (as noted from the basic dielectric expression). The observed decreases of $r(M)$ and $\Delta\varepsilon(M)$ suggested that the dimension ξ_m of the whole OS molecule (over which the cooperative torsion occurs) is smaller than the length scale ξ_c for the intermolecular cooperative motion and that ξ_m approaches ξ_c on an increase of M up to M^*. Consequently, the high-M PS molecules having $\xi_m > \xi_c$ exhibited the M-insensitive $r(M)$ and $\Delta\varepsilon(M)$. Thus, the M value for the crossover between these two regimes, $M^* \cong 2 \times 10^3$, can be taken as the molecular weight of the cooperative sequence along the PS backbone. Furthermore, the quantitative similarity of the viscoelastic and dielectric mode distributions suggests that the cooperative torsion of the repeating units along the molecular backbone is governed by the cross-correlation of the units belonging to different molecules.

Directional Terahertz Emission from Air Plasma Generated by Linearly Polarized Intense Femtosecond Laser Pulses
Jahangiri, F.; Hashida, M.; Tokita, S.; Nagashima, T.; Ohtani, K.; Hangyo, M.; Sakabe, S., *Applied Physics Express*, **5,** [026201-1]-[026201-3] (2012).
Abstract
Terahertz (THz) radiation from air plasma produced by linearly polarized intense femtosecond laser pulses was investigated. The laser energy dependence, directionality, and polarization properties of THz waves, measured in the present experiment, differed from those in previous reports and can be explained by parametric decay of laser light to R-waves in the presence of a spontaneous magnetic field.

Colossal Negative Thermal Expansion in $BiNiO_3$ Induced by Intermetallic Charge Transfer
Azuma, M.; Chen, W. T.; Seki, H.; Czapski, M.; Olga, S.; Oka, K.; Mizumaki, M.; Watanuki, T.; Ishimatsu, N.; Kawamura, N.; Ishiwata, S.; Tucker, M. G.; Shimakawa, Y.; Attfield, J. P., *Nature Communications*, [DOI: 10.1038/ncomms1361] (2011).
Abstract
The unusual property of negative thermal expansion is of fundamental interest and may be used to fabricate composites with zero or other controlled thermal expansion values. Here we report that colossal negative thermal expansion (defined as linear expansion $< -10^{-4}\ K^{-1}$ over a temperature range ~100 K) is accessible in perovskite oxides showing charge-transfer transitions. $BiNiO_3$ shows a 2.6% volume reduction under pressure due to a Bi/Ni charge transfer that is shifted to ambient pressure through lanthanum substitution for Bi. Changing proportions of coexisting low- and high-temperature phases leads to smooth volume shrinkage on heating. The crystallographic linear expansion coefficient for $Bi_{0.95}La_{0.05}NiO_3$ is $-137 \times 10^{-6}\ K^{-1}$ and a value of $-82 \times 10^{-6}\ K^{-1}$ is observed between 320 and 380 K from a dilatometric measurement on a ceramic pellet. Colossal negative thermal expansion materials operating at ambient conditions may also be accessible through metal-insulator transitions driven by other phenomena such as ferroelectric orders.

Preparation of Co_2FeSn Heusler Alloy Films and Magnetoresistance of Fe/MgO/Co_2FeSn Magnetic Tunnel Junctions
Tanaka, M. A.; Ishikawa, Y.; Wada, Y.; Hori, S.; Murata, A.; Horii, S.; Yamanishi, Y.; Mibu, K.; Kondou, K.; Ono, T.; Kasai, S., *Journal of Applied Physics*, **111,** [053902-1]-[053902-4] (2012).
Abstract
To obtain magnetic tunnel junctions (MTJs) composed of non-equilibrium alloy, Co_2FeSn films were prepared by atomically controlled alternate deposition at various substrate temperatures. X-ray diffraction patterns and Mössbauer spectra clarify that Co_2FeSn films in the Heusler alloy phase can be realized by growing at a substrate temperature of 250 ℃ or below. Phase separation into cubic CoSn, hexagonal CoSn and cubic CoFe phases occurs in films grown at substrate temperatures 300 ℃ or greater. Fe/MgO/Co_2FeSn MTJs were prepared with the Co_2FeSn layer grown at various substrate temperatures. The MTJs with the ferromagnetic Co_2FeSn layer grown at a substrate temperature of 250 ℃ showed tunnel magnetoresistance ratios of 72.2% and 43.5% at 2 K and 300 K, respectively.

Nanoparticles for *ex vivo* siRNA Delivery to Dendritic Cells for Cancer Vaccines: Programmed Endosomal Escape and Dissociation
Akita, H.; Kogure, K.; Moriguchi, R.; Nakamura, Y.; Higashi, T.; Nakamura, T.; Serada, S.; Fujimoto, M.; Naka, T.; Futaki, S.; Harashima, H., *Journal of Controlled Release,* **143,** 311-317 (2010).
Abstract
We previously developed octaarginine (R8)-modified lipid envelope-type nanoparticles for siRNA delivery (R8-MEND). Herein, we report on their *ex vivo* siRNA delivery to primary mouse bone marrow-derived dendritic cells (BMDCs) for poten-

tial use as a cancer vaccine. Quantitative imaging analysis of the intracellular trafficking of siRNA revealed that the dissociation process, as well as the rate of endosomal escape limits the siRNA efficiency of the prototype R8-MEND, prepared by the hydration method (R8-$MEND_{hydo}$). Successful endosomal escape was achieved by using a pH-dependent fusogenic peptide (GALA) modified on a lipid mixture that was optimized for endosomal fusion. Furthermore, a modified protocol for the preparation of nanoparticles, mixing the siRNA/STR-R8 complex and small unilamellar vesicles (R8/GALA-$MEND_{SUV}$), results in a more homogenous, smaller particle size, and results in a more efficient intracellular dissociation. Gene knockdown of the suppressor of cytokine signaling 1 (SOCS1), a negativefeedback regulator of the immune response in BMDCs resulted in an enhanced phosphorylation of STAT1, and the production of proinflammatory cytokines. Moreover, SOCS1-silenced BMDCs were more potent in suppressing tumor growth. Collectively, these results show that siRNA loaded in R8/GALA-$MEND_{SUV}$ efficiently suppresses endogenous gene expression and consequently enhances dendritic cell-based vaccine potency *in vivo*.